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THE FLOW-PERFORMANCE RELATION OF GREEN FUNDS: IS THERE A DIFFERENCE?

Bachelor's Thesis
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Abstract

This thesis examines the differences in investor behavior between green, other socially responsible and conventional funds. I use monthly return and total net asset data between 1991 and 2016 to examine the determinants of flow-performance relation of the three fund groups. My findings show that green fund flows are significantly more sensitive to contemporaneous results than other socially responsible (SRI) fund flows. This difference can also be seen in the convexity of the flow-performance relations as my findings indicate that non-green SRI investors heavily turn their focus to longer-term returns when facing negative short-term performance. This sets them apart from green and conventional investors. Additionally, my results show that ethical investors are more likely to invest in funds they already own. My findings also suggest that green fund investors chase good short-term past results and are likely to reinvest in their funds but are not as concerned about the long-term performance as conventional investors. Overall, the results reflect the non-financial criteria and the small pool of investment options with similar screening criteria that green and other SRI investors have.

Keywords: Socially responsible investing, Green funds, Flow-performance relation, Fund flows

Contents

1. Introduction

During the last few decades, socially responsible investing has seen a swift growth in popularity. According to the Forum for Sustainable and Responsible Investment (US SIF), socially responsible investments (SRI) accounted for 22 percent of all assets under professional management in the USA in 2016. Investing with a concern for environmental, social, and governance (ESG) issues is one of the most prevalent current trends in professional money management. This trend is also significant in fund investing in the USA. The Social Investment Forum (2016) listed 1002 investment funds incorporating ESG factors in 2016, while in 2005 the number of funds was 201. These funds have 2597 billion of net assets between them.

One of the more recent investment niches to arise from the larger socially responsible investment subject is green investing. It has a greater emphasis towards environmental than other ESG issues. Examples of green investing include investments in firms that produce ecological products, companies that commit to minimizing resource usage in production and companies that produce renewable energy. Green funds or environmental funds are a subset of mutual funds that specialize in promoting these environmental issues. There are also some more specific differences between environmental and other SRI funds. For example, green funds have more exposure to small caps than other SRI funds (Climent and Soriano, 2011). Benson et al. (2006) have also shown that the industry composition differs between green and other funds.

The popularity of responsible investing has also drawn numerous studies that examine the performance of green funds and especially SRI funds. One could intuitively think that ethical funds would achieve worse results on a financial basis because SRI investors gain both financial and non-financial utility from their investment choice. There is still no consensus on whether responsible funds provide as good returns as conventional funds on a raw return basis as study results have been mixed (for example Goldreyer and Diltz 1999; Benson et al., 2006). However, on a risk-adjusted basis, there does not seem to be any significant difference between the returns of the two fund groups (Goldreyer and Diltz, 1999; Statman, 2000). Studies on the performance of green funds such as White (1995) and Climent and Soriano (2011) have suggested that green funds have had significantly worse returns than their conventional peers have. However, Climent and Soriano (2011) state that environmental funds have fared better after the change of the millennium.

In addition to returns, fund flows and their drivers are also important issues for fund managers and investors. The relation between fund flows and returns for mutual funds has drawn numerous studies that indicate that flows heavily depend on funds´ past performances. Past performance has been shown to be an important source of information for an individual investor and is therefore expected to affect the flows of a mutual fund. (For instance Sirri and Tufano, 1998; Berk and Green, 2002) Results of studies comparing flows of SRI funds to conventional funds show that the flows of SRI funds are more sensitive to positive lagged returns and less sensitive to negative lagged results than conventional fund flows (Renneboog et al., 2006; Bollen, 2007). These findings support the assumption that ethical investors get non-financial utility and therefore are not as concerned about the financial performance. This issue has been explored in the SRI market as a whole by for example Bollen (2007) and Benson and Humphrey (2008). However, it has not yet been examined whether the flow behavior of green fund investors differs from that of other SRI investors and conventional investors.

The aim of this thesis is to examine how the effects of the main determinants of flow-performance relation differ between green, other SRI and conventional funds. I suggest that there might be some differences between the three fund groups, as environmentalists are often very passionate about their issue and have different non-financial incentives than other investors. Furthermore, as a somewhat small investment niche that has gained popularity lately, investors might still be slightly more critical towards the results compared to more established SRI funds. These factors could cause green investors' decision making to differ from that of others. My results show that non-green SRI flows are significantly less sensitive to current monthly returns than green and conventional fund flows, while all ethical fund flows are slightly less sensitive to annual returns. Moreover, all responsible fund flows are more persistent than conventional fund flows. The results reflect the ethical investors' non-financial goals and the small amount of SRI fund alternatives.

This thesis contributes to the existing literature by exploring the difference in flow-performance relation of US-based green and other SRI funds. Other studies have studied the flow-performance relation of US-based SRI funds as a whole group and the performance of green funds compared to other SRI. I believe, however, that the differences in the flow-performance relations of green and other SRI funds have not yet been studied. Therefore, I provide new insight into the environmental fund industry and the discussion on the flow-performance relation.

The remainder of this thesis is organized as follows: In section 2, I examine the background of fund flows and flow-performance relation and demonstrate why I expect to find differences in flow-performance relation of green, other SRI and conventional funds. Section 3 presents the data sample and research methodology used. In Section 4, I show the results of this thesis and compare them to the existing literature. Finally, I present my conclusions in section 5.

2. The research issues and hypotheses

Investors take into account many kinds of reasons and information when making their investment decisions. Returns are one of the most important factors for investors. A myriad of studies has been made of the relation between fund flows and returns of mutual funds. They have shown that fund flows depend on the past performance of a fund. This is explained by performance being an important source of information for an individual investor. (Capon et al., 1996; Sirri and Tufano, 1998; Berk and Green, 2002) Funds that perform well receive larger inflows. After all, investors seek returns for their investments. The flow-performance relation of mutual funds is asymmetric. This means that the funds with best results receive largest inflows of money while the poorest performers do not face similarly large outflows. (Sirri and Tufano, 1998; Del Guercio and Tkac, 2002) Investors use past performance make their investment decisions even though there is no consensus whether that performance persists (Brown and Goetzmann, 1995; Carhart, 1997). In fact, Berk and Green (2002) have argued that due to competitiveness of the mutual fund market and diminishing returns to scale, performance does not persist. Investors take both short- and long-term past performance into account when choosing their funds (Benson and Humphrey, 2008).

Empirical evidence such as Benson et al. (2006) shows that ethical funds allocate their investments differently than conventional funds, but there is no distinguishable difference in performance, fee levels nor managerial skills. However, Renneboog et al. (2006) and Bollen (2007) have shown that flows of SRI funds react differently to returns than conventional fund flows. Benson and Humphrey (2008) suggest that ethical fund flows are less sensitive to returns than others are. SRI funds offer investors both financial and non-financial utility. Due to these non-financial criteria, the SRI investors have different incentives and constraints than their conventional peers. This is likely to affect their flow-performance behavior as well, as it can be difficult to find an alternative fund with exactly similar ESG screening criteria should investors want to change the fund in which they invest. (Benson and Humphrey, 2008)

Green funds on the other hand have been shown to underperform at least their conventional counterparts (for instance White, 1995; Climent and Soriano, 2011; Chang et al., 2012). It has not yet been examined whether the flow-performance relation of environmental funds differs from that of the rest of SRI funds. Different types of funds attract different types of investors that can also have differences in their flow-decision behavior.[1] I reckon there might be a difference due to the criteria for environmental investing being even more restricted than that of the responsible investing industry. The studies and assumptions of green funds underperforming other funds might also have made investors a little more skeptical about green funds, which could affect the investment behavior. Furthermore, even though Benson and Humphrey (2008) could not find differences in the convexity of flow-performance between SRI and conventional funds, there might be some differences when SRI funds are divided in green and non-green funds. Considering this background, I test the following alternative hypotheses:

1) The coefficients of the flow-performance relation determinants of green funds differ significantly from those of non-green SRI funds.

2) There are differences in the convex relation of fund flows between green, non-green SRI and conventional funds due to flow-performance determinants reacting differently to negative returns.

To summarize, I study the relation between fund flows and returns of green, SRI and conventional funds in the US equity fund market in this thesis. I examine whether the behavior and decision-making of green fund investors differ statistically from those of conventional and non-green SRI fund investors by examining the determinants of the flow-performance relation of the three fund groups. Prior literature suggests that fund performance in both short and long term is an important source of information for investors and therefore affects the fund flows. Investors investing according to the ESG criteria have been shown to react differently to returns than conventional investors, which has been explained by the non-financial utilities and high search costs of ethical investments. These differences have been found even though more recent studies have suggested that there is no performance difference on a risk-adjusted basis. Some prior studies have examined the performance of green funds compared to their other SRI and

[1] An investor that is mostly interested in environmental issues might not get non-financial utility from a fund that only avoids investing in for example alcohol companies while another concerned with social issues does probably not derive that additional utility from a fund investing in alternative energy.

conventional peers, but in this thesis, I study whether the flow-performance behavior of green investors differs from that of other responsible and conventional investors.

3. Data and methodology

3.1 Data sample

My initial sample includes all US-based open-ended equity funds in the CRSP mutual fund database. I classify different share classes of a fund as the same fund and thus only one share class per fund is included to avoid counting funds multiple times. Of the share classes, I include the class first incepted. If many classes have been established at the same time, I include the one with most assets. I include both retail and institutional funds.[2] Moreover, I include both domestically and globally investing US-based funds but exclude index funds from the sample.

My main source for identifying SRI funds is a list of SRI funds of US SIF.[3] All the funds on the list are US-based. I identify all funds on the list as either a green fund or other SRI fund but take out non-equity funds. Some of the funds have no data of them in the CRSP database and therefore have to be excluded. In addition to the funds on the list, I include other funds that have Morningstar's sustainability mandate or clearly emphasize investing according to ESG values in their investing descriptions in these groups. There is not always a clear indication of which SRI funds are green funds. Therefore, on the US SIF list, I identify a fund as a green fund if it is marked to use positive environmental screening to find companies addressing the issues regarding climate, pollution and environment. Furthermore, I identify funds that have Morningstar's environmental sustainability mandate and funds that emphasize key words such as "green", "environmental", "clean energy", "emissions", "carbon" and "eco-friendly" in their name or investing description and strategy as green funds.

My final sample consists of 47 green funds, 65 other socially responsible funds and 9038 conventional funds.[4] I use CRSP mutual fund data to get monthly information on the returns, net asset values and expenses of the funds. The monthly returns used are net of expenses. The

[2] Retail and institutional funds could have differences between their flow-performance relation as James and Karceski (2006) have pointed out, but I want to avoid narrowing the SRI fund samples down too much.
[3] The updated list of US SIF can be found at http://charts.ussif.org/mfpc/?
[4] The final list of green and non-green SRI funds included can be found in the Appendix.

sample time period of monthly returns and flows used is between January 1991 and July 2016 because the consistent net asset value data of CRSP data is available for that time. I have trimmed the extreme TNA values of under 0.1 million to not have the flows of these very small funds control my results.[5] I interpret all unreported and clearly faulty[6] monthly observations as missing values. I also trim the most extreme values of monthly returns and relative flow changes out of the data to prevent them from distorting the results. After these changes, I have a total sample with 1 035 571 monthly TNA observations, 1 028 663 monthly return observations and 1 018 802 monthly flow observations.

3.2 Flow-performance methodology

In this thesis, I examine the flow-performance relations of green, other socially responsible and conventional funds in four different ways. First, I examine the flow-performance relations of green and other SRI funds to test whether there is any difference or not. Then, I add conventional funds to the mix and compare the three fund groups. Lastly, I test the differences in the reaction to negative monthly performance between all three fund groups and SRI only.

In order to answer whether the flow-performance relations of different types of funds differ, I implement the flow-performance methodology employed in prior studies of the relation (see for example, Sirri and Tufano, 1998; Bollen, 2007; Benson and Humphrey, 2008). I calculate relative flows instead of actual dollar flows to keep the very large funds from controlling my results. In equation 1, I calculate fund flows as a percentage of the total net assets of the month t-1. Equation 1 is modeled as follows:

$$Fl_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + RM_{i,t})}{TNA_{i,t-1}} \tag{1}$$

where $\mathrm{TNA}_{i,t}$ is the total net assets of fund *i* at time *t* and $RM_{i,t}$ is the monthly return of fund *i* at time *t*. In this base model of fund flows, I follow Chevalier and Ellison (1997), Sirri and Tufano (1998) and Ferreira et al. (2012). The model takes into account the importance and effect that past returns have on fund flows.

[5] Bollen (2007) excludes all funds that have TNA of under 10 $million in his study but I settle for 0.1 $million to avoid narrowing the already small samples of green and SRI funds down too much.
[6] In some rare cases, CRSP data reports fund TNA values of -99 $million.

The full flow-performance relation model is a function comprised of contemporaneous and past returns and past fund flows. It includes 1-, 2- and 3-month lagged return variables. Fund age is also included in the model, as for example Chevalier and Ellison (1997) have shown that it affects the relation. Equation 2 examines the differences in flow-performance determinants between green and other ethical funds. A dummy variable for green funds is included in the equation to show the difference in flow-performance relation between green and other SRI funds. I follow and expand the model of Benson and Humphrey (2008) to measure the differences between the determinants of the fund groups' flow-performance relation.[7] Equation 2 is modeled as follows:

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \alpha_{j+4} X_{i,t-1}^{j} + GF_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \alpha_{j+4} X_{i,t-1}^{j} \right) + \varepsilon_{i,t} \quad (2)$$

where $Fl_{i,t}$ is the relative monthly flow of fund *i*, at time *t*, calculated as in equation 1. $RM_{i,t}$ is the monthly return on fund *i* at time *t*. $RA_{i,t}$ is the annual return on fund *i* at time *t*, measured by a calculating cumulative returns of previous 12 months. $X_{i,t}^{1}$ is the monthly flow of fund *i* at time *t*. $X_{i,t}^{2}$ is the age of fund *i* in months at time *t*. These determinants of flow-performance relation remain unchanged in all the following equations. GF_i is 1 for green funds, 0 otherwise.

Equation 3 adds conventional funds to the mix and examines the differences in flow-performance relation determinants of conventional, green and other SRI funds. The equation includes different interaction variables for green funds and non-green SRI funds. Equation 3 is modeled as follows:

[7] Benson and Humphrey (2008) only examine the difference between all SRI and conventional funds but I expand the model by dividing SRI into two groups. They also measure fund flows as actual dollar flows.

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \alpha_{j+4} X_{i,t-1}^{j} + SR_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \beta_{j+4} X_{i,t-1}^{j} \right) + GF_i \left(\sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \gamma_{j+4} X_{i,t-1}^{j} \right) + \varepsilon_{i,t} \quad (3)$$

where, SR_i is 1 for non-green SRI funds, 0 otherwise. GF_i is 1 for green funds, 0 otherwise. No funds are included in both groups.

To test the difference in flow-performance relation when a fund faces negative results, I include a regression with an interaction variable that is 1 for months with negative returns and 0 for ones with positive returns. Equation 4 expands the model used in equation 3 by adding a dummy variable $NRM_{i,t}$ that takes the effect of negative return into account. I dummy the contemporaneous monthly return, 1-month lagged return and annual return to see whether these explanatory variables have different coefficients when the monthly return is negative. These negative result interaction variables show how the importance of different period returns changes when the current return is negative. Equation 4 is modeled as follows:

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \alpha_{j+4} X_{i,t-1}^{j} + \sum_{j=0}^{1} \lambda_j RM_{i,t-j} * NRM_{i,t} + \lambda_2 RA_{i,t}^{j} * NRM_{i,t} + SR_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \beta_{j+4} X_{i,t-1}^{j} + \sum_{j=0}^{1} \theta_j RM_{i,t-j} * NRM_{i,t} + \theta_2 RA_{i,t}^{j} * NRM_{i,t} \right) + GF_i \left(\sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \gamma_{j+4} X_{i,t-1}^{j} + \sum_{j=0}^{1} \delta_j RM_{i,t-j} * NRM_{i,t} + \delta_2 RA_{i,t}^{j} * NRM_{i,t} \right) + \varepsilon_{i,t} \quad (4)$$

where $NRM_{i,t}$ = 1 if return of fund *i* is negative in month *t*, 0 otherwise.

I examine the difference in the effects of positive and negative performance differently than for instance Benson and Humphrey (2008). They divide funds into quartiles based on their returns to compare the relations but I do not because dividing already small groups of green and other SRI funds would lead to very small quartiles. The interaction variables for negative monthly return that I use give an insight into whether responsible investors react differently or are more tolerant of negative contemporaneous returns than conventional investors are.

Finally, to test the differences in negative result interaction variables between green and other SRI funds, I revert the model back to an expanded version of equation 2. Equation 5 is otherwise similar to equation 4 but the base model is formed of only SRI funds and green funds are then separated with the interaction variable GF_i. Equation 5 is modeled as follows:

$$\begin{aligned} Fl_{i,t} = & \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \alpha_{j+4} X_{i,t-1}^{j} \\ & + \sum_{\mathrm{j}=0}^{1} \lambda_j RM_{i,t-j} \ * \ NRM_{i,t} + \lambda_2 RA_{i,t}^{j} * NRM_{i,t} \\ & + GF_i \left(\begin{array}{l} \sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA_{i,t}^{j} + \sum_{j=1}^{2} \gamma_{j+4} X_{i,t-1}^{j} \\ + \sum_{j=0}^{1} \delta_j RM_{i,t-j} * NRM_{i,t} + \delta_2 RA_{i,t}^{j} * NRM_{i,t} \end{array} \right) + \varepsilon_{i,t} \end{aligned} \tag{5}$$

where, $Fl_{i,t}$ is the flow of SRI fund *i* at time *t*. GF_i is 1 for green funds, 0 otherwise.

4. Results

4.1 Descriptive statistics

Table 1
Descriptive statistics

Table 1 presents descriptive statistics of the samples of green, non-green SRI and conventional funds used in this thesis.

	Total net assets ($millions)	Monthly return	Monthly flow (relative)	Annual return	Age (months)	Expense ratio
Green funds						
Mean	327	0.01	0.02	0.07	104	0.01
Standard deviation	808	0.05	0.09	0.20	78	0.007
Median	61	0,01	0,003	0,09	85	0,01
Minimum	0.1	-0.37	-0.45	-0.68	1	0
Maximum	9235	0.31	1.50	1.21	307	0.14
Observations	6990	6986	6923	7003	7003	565
Non-green SRI funds						
Mean	1735	0.01	0.02	0.08	98	0.01
Standard deviation	8229	0.05	0.08	0.19	73	0.004
Median	55	0,01	0,002	0,09	83	0,01
Minimum	0.1	-0.29	-0.42	-0.63	1	0.002
Maximum	73035	0.29	1.25	1,33	307	0.03
Observations	8520	8529	8430	8529	8529	672
Conventional funds						
Mean	664	0,01	0.02	0.08	87	0.01
Standard deviation	3042	0.05	0.13	0.22	71	0.01
Median	68	0,01	-0,001	0,09	69	0,01
Minimum	0.1	-0.66	-0.70	-0.90	1	0
Maximum	109796	0.66	2.00	7,25	307	0.32
Observations	1019560	1013126	1004270	1021834	1021834	77893
Kruskal-Wallis test statistics						
Green vs SRI	18.08**	0.21	0.10	0.35	7.27**	5.96
Green vs Conventional	18.81**	0.01	206.67**	0.78	268.63**	3.40
SRI vs Conventional	0.30	0.32	263.77**	0.003	208.13**	1.49

** Significant at 1% level

Table 1 presents descriptive statistics for the samples of green, other SRI and conventional funds. The most interesting finding in these statistics might be that contrary to the findings of some prior green fund performance studies, I find that green funds do not provide lower average monthly returns than other SRI and conventional funds.

Furthermore, consistent with Climent and Soriano (2011), I find that conventional funds have higher average TNA than ethical funds.[8] The results also show that both groups of ethical funds receive higher average fund flows than conventional funds. This finding is in line with Benson & Humphrey (2008). Another important observation is that there are no significant differences between the expense ratios of the three fund groups. As the monthly return data used is net of expenses, it is important to acknowledge that expense rates are not causing differences between the groups and therefore should not be creating differences in flow-performance relation.

I implement a Kruskal-Wallis median test to examine whether the statistics show significant differences between the groups. According to the test, the three groups have some significant differences between them. Between environmental and other SRI funds, there are significant differences in TNA and fund age. Green and conventional funds differ significantly in TNA, monthly flow and fund age. Lastly, the significant differences between non-green SRI and conventional funds are in fund flows and fund age.

4.2 Flow-performance relation differences between green and other SRI funds

Table 2 presents the results of equation 2. It presents coefficients and t-statistics of the flow-performance relation determinants for non-green ethical funds and compares those to the green fund determinants. The "Non-Green SRI" columns present coefficients of flow-performance relation for non-green SRI as a base group. I present the coefficients that show how the effects of the determinants differ for green fund flows in the "Green Funds" columns.

[8] The largest non-green SRI fund, Washington Mutual Investors Fund, distorts the non-green SRI funds' TNA statistics. The mean TNA of non-green SRI funds is 256.2 $million, standard deviation is 468.7 $million, median is 50.5 $million and maximum is 3885.7 $million when calculating without the fund.

Table 2
Flow-performance relation – Green fund & non-green SRI comparison

Table 2 presents the coefficients of the flow-performance relation determinants for non-green SRI funds and shows how those differ for green funds. The actual coefficients of green fund flow determinants can be calculated by adding the green fund differential coefficient to the non-green SRI coefficient. The results are calculated as in equation 2. $RM_{i,t}$ is the monthly return on fund *i* at time *t*. $RA_{i,t}$ is the annual return on fund *i* at time *t*, measured by a calculating cumulative returns of previous 12 months. $X^1_{i,t}$ is the monthly flow of fund *i* at time *t*. $X^2_{i,t}$ is the age of fund *i* in months at time *t*. GF_i is 1 for green funds, 0 otherwise.

	Non-Green SRI		Green Funds	
	Coefficient	t-statistic	Coefficient	t-statistic
Monthly return	0.015	0.86	0.088	3.58***
1-month lagged return	0.068	3.90***	0.019	0.77
2-month lagged return	0.0001	0.99	0.023	0.93
3-month lagged return	0.039	2.23*	-0.001	-0.49
Lagged flow	0.258	24.97***	0.015	0.44
Annual return	0.010	2.00*	-0.007	-1.02
Age	-0.00017	-14.68***	0.00005	2.86**

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA^j_{i,t} + \sum_{j=1}^{2} \alpha_{j+4} X^j_{i,t-1} + GF_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA^j_{i,t} + \sum_{j=1}^{2} \alpha_{j+4} X^j_{i,t-1} \right) + \varepsilon_{i,t} \quad (2)$$

* Significant at 5% level
** Significant at 1% level
*** Significant at 0.1% level

The results show that non-green SRI fund flows react quite insignificantly to current monthly return. It is interesting that according to this result, 1-month lagged return is a much more significant explanatory variable for non-green SRI fund flows than contemporaneous return. Other determinants with significant coefficients in the flow-performance relation model are 3-month lagged returns, lagged fund flows and annual returns. This shows that although non-green SRI investors are less concerned about current returns, past returns do matter for them. This finding is consistent with Benson and Humphrey (2008). The coefficient of lagged flow is positive and significant showing that SRI flows are persistent and that ethical investors are likely to reinvest in their funds. Fund age has also a significantly negative effect on non-green SRI fund flows. This suggests that older funds face less flow than younger founds, which for example Chevalier and Ellison (2007) have shown to be the case for mutual funds in general.

The "Green Funds" columns of Table 2 show that there are significant differences in the flow-performance relations of green and other SRI funds. Interestingly, according to the results, green funds are significantly more sensitive to contemporaneous returns than other SRI funds. Green fund flows seem also significantly less negatively sensitive to the age of a fund. The coefficient of green fund lagged flows is positive but insignificant. This shows that lagged flows are a significant contributor to green fund flows but not significantly more so than they are to non-green fund flows. The green fund coefficients of annual and lagged monthly returns are also insignificant, which implies that the importance of past returns is quite similar for all ethical funds, green funds included.

Overall, the results for SRI funds are quite consistent with prior studies while also showing new findings. They suggest that there is a difference in the flow-performance relation for green and non-green funds, thus supporting my hypothesis number 1. This indicates that the investment behavior of environmental investors possibly differs from that of otherwise responsible investors and is to my knowledge a new finding.

4.3 Flow-performance relation of conventional, non-green SRI and green funds

Table 3 presents the results of equation 3. The first two result columns show the coefficients and t-statistics for the flow-performance relation determinants of conventional funds. I present the difference coefficients for non-green SRI and green funds in the next columns. They show whether determinants' coefficients are significantly different for green and non-green SRI funds than they are for conventional funds.

The results for conventional funds show that all the explanatory variables used are overall significant contributors to fund flows. Both current and lagged returns as well as annual returns have significant and positive coefficients. This suggests that investors use both short and long-term performance information when considering their investments, which is consistent with the findings of Benson and Humphrey (2008). The coefficient of lagged flow is also positive and significant which implies that investors are likely to reinvest in their chosen funds. Cashman et al. (2007) have also documented this phenomenon. The coefficient of age, however, is negative and significant showing that older funds witness less flow, again supporting Chevalier and Ellison (2007).

Table 3
Flow-performance relation – Comparison of green, non-green SRI and conventional funds

Table 3 presents the coefficients of the flow-performance relation determinants for conventional funds and shows the differences in those for non-green SRI and green funds as calculated in equation 3. The actual coefficients of green and non-green SRI fund flow determinants can be calculated by adding the corresponding differential coefficient to the conventional funds' coefficient. $RM_{i,t}$ is the monthly return on fund *i* at time *t*. $RA_{i,t}$ is the annual return on fund *i* at time *t*, measured by calculating cumulative returns of previous 12 months. $X^1_{i,t}$ is the monthly flow of fund *i* at time *t*. $X^2_{i,t}$ is the age of fund *i* in months at time *t*. SR_i is 1 for SRI funds excluding green funds, 0 otherwise and GF_i is 1 for green funds, 0 otherwise.

	Conventional Funds		Non-Green SRI Funds		Green Funds	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Monthly return	0.087	41.52***	-0.072	-2.89**	0.016	0.61
1-month lagged return	0.048	22.59***	0.020	0.79	0.039	1.51
2-month lagged return	0.017	8.10***	-0.017	-0.67	0.006	0.23
3-month lagged return	0.020	9.36***	0.019	0.76	0.007	0.27
Lagged flow	0.204	214.68***	0.055	3.64***	0.061	3.89***
Annual return	0.023	39.12***	-0.013	-1.85	-0.020	-2.78**
Age	-0.00019	-124.47***	0.00003	1.63	0.00007	4.35***

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA^j_{i,t} + \sum_{j=1}^{2} \alpha_{j+4} X^j_{i,t-1} + SR_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA^j_{i,t} + \sum_{j=1}^{2} \beta_{j+4} X^j_{i,t-1} \right) + GF_i \left(\sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA^j_{i,t} + \sum_{j=1}^{2} \gamma_{j+4} X^j_{i,t-1} \right) + \varepsilon_{i,t} \quad (3)$$

* Significant at 5% level
** Significant at 1% level
*** Significant at 0.1% level

Moving on to the flow-performance relation coefficients of non-green SRI funds, there are some significant differences compared to conventional funds. First, the coefficient of monthly return is negative and significant at 1% level. This suggests that non-green SRI funds are significantly less sensitive to current performance than conventional funds. Consistent with the Table 2 results, these results suggest that non-green SRI fund investors are not that concerned about current performance while conventional investors are. The coefficients of lagged and annual returns are insignificant showing that importance of past returns is not that different between the groups. The coefficient of lagged flow is significantly positive showing that non-green SRI flows are more persistent than conventional flows. These findings are mostly in line with Benson and Humphrey (2008). The coefficients of first and third lagged returns and age are positive but insignificant while 2-month lagged return and annual return have negative and insignificant coefficients.

Turning the focus to the flow-performance relation of green funds, some of the coefficients show significant differences between green and conventional funds. The one clear difference separating green and non-green SRI flow-performance relation is that for green funds, the monthly return coefficient is insignificant and positive. The coefficients of all three lagged flow variables are insignificant as well. This is in line with the Table 2 result of green fund investors being more sensitive to short-term performance than other SRI investors are. In fact, the relation results involving monthly current and past returns of green funds are very close to those of conventional funds.

Green fund coefficients of lagged flow, annual return and age, however, differ significantly from those of conventional funds. As Table 2 showed, the effect of lagged flow is significant for all SRI fund flows. It seems to be even more significant for green funds, as their coefficient is slightly greater. The lagged flow coefficient is significantly positive at 0.1% level suggesting that green fund investors are particularly likely to invest in funds in which they have already invested. The persistence of green and other SRI flows supports the findings of Benson and Humphrey (2008) and reflects their high search costs for alternative funds.

The differential coefficient of annual return is significantly negative for green funds. This implies that green investors are not as concerned about past long-term performance as conventional and other SRI investors. This finding combined with the coefficient results of shorter-term returns and lagged flows interestingly suggests that green fund investors chase good short-term results and are likely to reinvest in the funds but are not that concerned about the long-term past performance.

The differential coefficient of age is positive and significant for green funds. This shows that green fund flows do not have as negative relation with fund age as conventional fund flows. The differential coefficient of age is also positive for non-green SRI funds but not as significantly as for green funds. The significantly persistent flows that green funds receive could be one reason behind this.

Overall, the results of Table 3 support those of Table 2. The main differences between green and other SRI fund flow-performance relation are in contemporaneous returns and age. Furthermore, Table 3 shows that the effect of annual return to fund flows differs between ethical and conventional funds. This difference is just not that significant for non-green funds than it

is for green funds. The findings again support my research hypothesis number 1 while also showing differences to conventional funds.

4.4 Flow-performance relation with negative result interaction variables

Table 4 shows the results of equation 4. It examines the effect of a negative monthly return on some main flow-performance determinants. As in Table 3, the first two result columns show the coefficients and t-statistics of flow-performance relation determinants of conventional funds while the difference coefficients for non-green SRI and green funds are presented in the other columns. The three last determinants of the table are the interaction variables for monthly return, 1 month lagged return and annual return for months with negative results. They show how much the returns from different periods affect investors' flow decisions when facing a month of negative performance. The actual coefficient of for example monthly return for a negative return month can be calculated by adding the interaction variable coefficient (λ^1) to the monthly return coefficient (α^1).

Overall, the results here are very similar to those in Table 3. All the explanatory variables used are still significant for conventional funds. Furthermore, the negative result interaction variable coefficients are all significant and negative. This means that when the current performance of a fund is negative, the actual coefficients for monthly return, 1-month lagged return and annual return are only 0,045, 0,024 and 0,011 respectively. This supports the asymmetric relation where flows are less sensitive to performance when performance is bad.

Most of the differences between conventional, non-green SRI and green fund flow determinants in Table 4 remain consistent with the Table 3 results. However, one interesting change is that the annual return coefficient for non-green SRI funds has become significantly negative at 5% level while the green funds' coefficient is now significant only at 10% level. Furthermore, the coefficient of monthly non-green SRI funds has lost some of its significance.

Table 4
Flow-performance relation – Negative result interaction variables

Table 4 presents the difference in the flow-performance relation determinants for conventional funds, SRI funds and green funds adding the interaction variable for negative results as they are calculated in equation 4. $RM_{i,t}$ is the monthly return on fund *i* at time *t*. $RA_{i,t}$ is the annual return on fund *i* at time *t*, calculated as cumulative returns of previous 12 months. $X^1_{i,t}$ is the monthly flow of fund *i* at time *t*. $X^2_{i,t}$ is the age of fund *i* in months at time *t*. SR_i is 1 for SRI funds excluding green funds, 0 otherwise and GF_i is 1 for green funds, 0 otherwise. $NRM_{i,t}$ = 1 if return of fund i is negative in month t, 0 otherwise. Variables RM negative, RM-1 negative and RA negative show the differences in monthly return, 1 month lagged return and annual return coefficients respectively when a fund faces a month with negative return.

	Conventional Funds		Non-Green SRI Funds		Green Funds	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Monthly return	0.172	41.27***	-0.128	-2.45*	0.006	0.11
1-month lagged return	0.091	32.29***	-0.039	-1.15	0.036	1.07
2-month lagged return	0.016	7.49***	-0.013	0.53	0.007	0.26
3-month lagged return	0.024	11.41***	0.020	0.77	0.008	0.30
Lagged flow	0.204	214.57***	0.054	3.61***	0.060	3.80***
Annual return	0.033	45.87***	-0.021	-2.44*	-0.017	-1.89
Age	-0.00019	-123.90***	0.00003	1.63	0.00007	4.38***
RM negative	-0.127	-20.50***	0.034	0.44	0.030	0.38
RM-1 negative	-0.067	-15.66***	0.123	2.35*	0.002	0.04
RA negative	-0.021	-18.84***	0.016	1.15	-0.007	-0.49

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA^1_{i,t} + \sum_{j=1}^{2} \alpha_{j+4} X^j_{i,t-1} + \sum_{j=0}^{1} \lambda_j RM_{i,t-j} * NRM_{i,t} + \lambda_2 RA^1_{i,t} * NRM_{i,t} + SR_i \left(\sum_{j=0}^{3} \beta_j RM_{i,t-j} + \beta_4 RA^1_{i,t} + \sum_{j=1}^{2} \beta_{j+4} X^j_{i,t-1} + \sum_{j=0}^{1} \theta_j RM_{i,t-j} * NRM_{i,t} + \theta_2 RA^1_{i,t} * NRM_{i,t} \right) + GF_i \left(\sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA^1_{i,t} + \sum_{j=1}^{2} \gamma_{j+4} X^j_{i,t-1} + \sum_{j=0}^{1} \delta_j RM_{i,t-j} * NRM_{i,t} + \delta_2 RA^1_{i,t} * NRM_{i,t} \right) + \varepsilon_{i,t} \quad (4)$$

* Significant at 5% level
** Significant at 1% level
*** Significant at 0.1% level

Almost all of the negative result interaction variable coefficients of green and non-green SRI funds are insignificant. The only significant difference is the 1-month lagged return for non-green SRI which has a positive coefficient. It is also the only negative result coefficient to have different direction than the other two fund groups. This suggests that when the return of current month is negative, the return of the previous month has larger impact for non-green SRI investors than the return of the current month. This reflects the smaller importance of contemporaneous performance for non-green ethical investors. All three coefficients on

negative return interaction variables of green funds are insignificant. This finding suggests that there is no difference in the convexity of flow-performance relation for green and conventional funds. These findings partially support my hypothesis number 2 but not wholly. Benson and Humphrey (2008) do not find differences in the convexity of conventional and SRI flow-performance relations. Therefore, my findings partly differ from theirs.[9]

Table 5 shows the results calculated using equation 5. It presents an otherwise similar model as Table 4 but shifts the focus back to SRI funds. The results presented in table 5 are mostly in line with those of Tables 2 and 4. For other SRI funds, the coefficient of monthly returns is still insignificant while those of second and third lag also remain largely consistent with Table 2. The most notable changes from Table 2 are the lowered significance of 1-month lagged and annual returns. For green funds, the coefficient of age is still significant while the coefficients of second and third month lagged returns, lagged flow and annual return are insignificant, just as they were in Table 2. However, there are some changes as the significance of the coefficient for monthly return has decreased but not enough to make it insignificant. Furthermore, 1 month lagged return has now a significantly positive coefficient at a 5% level. The directions of these coefficients remain the same.

The negative result interaction variable results are mostly consistent with those in Table 4 but point out some interesting details. Contrary to the Table 4 results, all three negative result coefficients of non-green SRI funds are insignificant. This implies that there is a difference in the convexity of flow-performance relation between non-green SRI funds and conventional funds. However, this could just be because the non-green SRI funds' base coefficients of monthly and annual returns are already insignificant. In addition, Table 4 showed no significant differences between the two groups' coefficients. For green funds, the coefficient of 1-month lagged return differs significantly from other SRI while the returns for current month and past year do not. The significant difference in this coefficient is a result of the difference seen in Table 4. There, both conventional and green funds have negative coefficients (-0.067 and -0,064 respectively) while non-green SRI funds have a positive one (0.055). This further reflects the difference in behavior for non-green SRI investors; they are not as sensitive to current returns as conventional and green investors are but they put more weight to longer-term past returns instead of the current returns.

[9] Note that I test the convexity in a slightly different way than Benson and Humphrey (2008).

Table 5
Flow-performance relation of SRI funds – Negative result interaction variables

Table 5 presents the difference in the flow-performance relation determinants for SRI funds and green funds as calculated in equation 5. The actual coefficients of green fund flow determinants can be calculated by adding the green fund differential coefficient to the non-green SRI coefficient. $RM_{i,t}$ is the monthly return on fund *i* at time *t*. $RA_{i,t}$ is the annual return on fund *i* at time *t*, calculated as cumulative returns of previous 12 months. $X^1_{i,t}$ is the monthly flow of fund *i* at time *t*. $X^2_{i,t}$ is the age of fund *i* in months at time *t*. GF_i is 1 for green funds, 0 otherwise. $NRM_{i,t}$ = 1 if return of fund *i* is negative in month *t*, 0 otherwise. Variables RM negative, RM-1 negative and RA negative show the differences in monthly return, 1 month lagged return and annual return coefficients respectively when a fund faces a month with negative return.

	All SRI		Green Funds	
	Coefficient	t-statistic	Coefficient	t-statistic
Monthly return	0.045	1.24	0.134	2.57*
1-month lagged return	0.052	2.24*	0.075	2.29*
2-month lagged return	0.002	0.14	0.020	0.81
3-month lagged return	0.044	2.49*	-0.012	-0.46
Lagged flow	0.258	24.93***	0.006	0.38
Annual return	0.012	1.958	0.004	0.46
Age	-0.00017	-14.56***	0.00005	2.88**
RM negative	-0.093	-1.73	0.004	-0.05
RM-1 negative	0.055	1.54	-0.121	-2.37*
RA negative	-0.005	-0.55	-0.023	-1.66

$$Fl_{i,t} = \sum_{j=0}^{3} \alpha_j RM_{i,t-j} + \alpha_4 RA^j_{i,t} + \sum_{j=1}^{2} \alpha_{j+4} X^j_{i,t-1} + \sum_{j=0}^{1} \lambda_j RM_{i,t-j} * NRM_{i,t} + \lambda_2 RA^j_{i,t} * NRM_{i,t} + GF_i \left(\sum_{j=0}^{3} \gamma_j RM_{i,t-j} + \gamma_4 RA^j_{i,t} + \sum_{j=1}^{2} \gamma_{j+4} X^j_{i,t-1} + \sum_{j=0}^{1} \delta_j RM_{i,t-j} * NRM_{i,t} + \delta_2 RA^j_{i,t} * NRM_{i,t} \right) + \varepsilon_{i,t} \quad (5)$$

* Significant at 5% level
** Significant at 1% level
*** Significant at 0.1% level

To conclude, the results as a whole support my hypothesis number 1 by documenting that there are significant differences in the flow-performance relation between green, non-green SRI and conventional funds. Both SRI groups have significantly more persistent flows, which reflects the scarcity of alternative funds with similar non-financial goals. Non-green SRI flows are less sensitive to contemporaneous returns than green and conventional fund flows. On the other hand, green fund flows do not relate as negatively to fund age as the flows of the other two groups. I document the asymmetric flow-performance relation for all three fund groups by

showing that current monthly and annual return have lesser effect to fund flows when funds face a month of negative performance. However, when non-green SRI funds have a month with negative returns, the importance of prior month's returns heightens for them. This is a complete opposite to the effect for conventional and green fund flows. This finding supports my hypothesis number 2 by indicating that some differences might exist in the convexity of the different fund groups' flow-performance relation.

5. Conclusions

The growing level of environmental awareness and demand for responsibility has resulted in a noticeable increase in environmentally and otherwise responsible investing. This rise in popularity has also drawn many studies on the returns and flow-performance relation of responsible funds. The studies have found little difference in the performance between SRI and conventional funds as even green funds once shown to underperform have stepped up in the 2000s. In this thesis, I divide SRI funds in green and other SRI funds and study whether there are differences to be found in the flow-performance behavior between them and conventional funds.

I implemented flow-performance methodology to examine the determinants of US-based equity funds' flow-performance relation. I used monthly return and total net asset data of CRSP during the period between January 1991 and July 2016. I used monthly and annual past returns, past flows and fund age in my model. I examined the difference in the determinants of the relation between green, other SRI, and conventional funds to see whether the flows of different types of funds react differently to them. I measured the difference by adding interaction variables for green and other SRI funds to show the difference between the coefficients of the different groups' determinants. I started by examining the flow-performance relations of green and other SRI funds to see whether there is actually any difference between them. Then, I added conventional funds to the comparison and compared the flow-performance relation of the three fund groups. Lastly, I tested the differences in the reaction to negative monthly performance by first comparing all three fund groups and then SRI funds only.

My results indicate that, overall, both green and other SRI fund flows are significantly more sensitive to the fund flow of previous month than conventional fund flows. This finding supports the prior documented findings by suggesting that ethical investors are more likely to

reinvest in funds in which they have already invested and are less likely to switch funds. Another finding is that non-green SRI funds are significantly less sensitive to current returns than green and conventional funds whose flows react quite similarly to current returns. This suggests that non-green SRI fund investors are not that concerned about current performance. Both green and non-green SRI fund flows are also slightly less sensitive to annual returns than conventional funds are.

I find that green fund flows do not relate as negatively to fund age as the flows of the other two groups. This could be due to the high persistence of green fund flows. Furthermore, the small number of alternative funds can be a factor in this. The convexity of flow-performance relation, however, does not seem different for green and conventional funds. The significance of 1-month lagged returns when facing negative performance is also the only found difference separating non-green SRI funds from the other two groups. This difference further emphasizes the finding that for non-green SRI investors, medium (past months) and long (annual) past performance matter more than current returns.

This study provides further insight into the environmental fund industry and the differences it has in comparison with the rest of the SRI industry. Overall, green, non-green SRI and conventional investors all use past performance in investment decision-making but weight returns of different periods and other flow-performance drivers slightly differently. Future research might want to focus on other subsets of SRI funds such as religious funds to expand the existing knowledge of the different branches of responsible investing.

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Appendix: List of SRI funds included

Green funds:

Alger Green
Allianz RCM Global EcoTrends
AllianzGl Global Water Fund
Ariel Appreciation Fund
Ariel Focus Fund
Ariel Fund
Brown Advisory Sustainable Growth Fund
Calvert Global Energy Solutions Fund
Calvert Global Water Fund
ClearBridge Sustainability Leaders Fund
DFA US Sustainability Core 1
DFA International Sustainability Core 1
DWS Climate Change
Domini International Social Equity Fund
Domini Social Equity Fund
Dreyfus Third Century
Epiphany FFV Global Ecologic Fund
Great-West Ariel Mid Cap Value Fund
Green Century Equity
Guinness Atkinson Alternative Energy
Fidelity Select Environmental Portfolio
Firsthand Alternative Energy Fund
Leuthold Global Clean Technology Fund
Neuberger Berman Socially Responsible Fund
New Alternatives
Parnassus Asia Fund
Parnassus Core Equity Fund
Parnassus Endeavor Fund
Parnassus Fund
Parnassus Mid Cap Fund
Pax ESG Beta Quality Fund
Pax Global Environmental Markets Fund
Portfolio 21 Global Equity Fund
Praxis Growth Fund
Praxis International Fund
Praxis Small Cap Fund
Praxis Value Fund
Sentinel Sustainable Core Opportunities Fund
Shelton Green Alpha Fund
TIAA-CREF Social Choice Equity Fund
UBS International Sustainable Equity Fund
Walden Equity Fund
Walden Small Cap Innovations Fund
Walden SMID Cap Innovations Fund
Walden Mid Cap Fund
Winslow Green Growth Fund
Winslow Green Solutions

Non-Green SRI funds:

AHA Socially Responsible Equity Fund
AllianzGl Global Sustainability
Amana Developing World
Amana Growth
Amana Income
American Century Emerging Markets
American Century Global Growth
American Century International Growth
American Century NT Core Equity Plus
American Century NT Large Core Value
American Century NT Disciplined Growth
American Century Sustainable Equity
American Trust Allegiance Fun
Ariel Discovery Fund
Appleseed Fund
Ave Maria Catholic Values
Ave Maria Growth
Ave Maria Rising Dividend Fund
Ave Maria World Equity Fund
Azzad Ethical Fund
Boston Common Large Cap Core Equity Fund
Boston Common International Fund
Calvert Equity Portfolio
Calvert Capital Accumulation Fund
Calvert Small Cap Fund
Calvert Emerging Markets Equity Fund
Calvert U.S. Large Cap Core Responsible
Calvert U.S. Large Cap Growth Responsible
Calvert U.S. Large Cap Value Responsible
DFA Emerging Markets Social Core
DFA International Social Core Equity
DFA US Social Core Equity 2 Portfolio
Domini European Social Equity Fund
Domini Pac Asia Social Equity Fund
Epiphany Faith and Family Values
Epiphany FFV Latin America
Eventide Gilead
Eventide Healthcare & Income
Gabelli SRI
GuideStone Funds Growth Equity
GuideStone Funds Value Equity
Iman Fund
Integrity Growth & Income
Invesco Summit
LKCM Aquinas Catholic Equity
Matthews Asia ESG
New Covenant Growth Fund
Pax Ellevate Global Women's Fund
Pax Small Cap Fund
Pax MSCI International ESG
Saturna Sustainable Equity Fund
SEI Catholic Values Equity
SEI Large Cap Diversified Alpha
Steward Large Cap Enhaced
Steward Small-Mid Cap Enhanced
Timothy Plan Aggressive Growth
Timothy Plan Emerging Markets
Timothy Plan Large/Mid Cap Growth
Timothy Plan Large/Mid Cap Value
Timothy Plan Small Cap Value
Trillium Small/Mid Cap Mutual Fund
Touchstone Premium Yield Equity Fund
Touchstone Sustainability & Impact Equity
Valic Company II Socially Responsible Fund
Washington Mutual Investors Fund